SEQUENCE LISTING

<110> Zhu, Hai-Ying
Ling, Kai-Shu
Gonsalves, Dennis

<120> Grapevine Leafroll Virus Type 2 Proteins
and Their Uses

<130> 07678/062004

<140> US 09/613,486
<141> 2000-07-11

<150> US 09/080,983
<151> 1998-05-19

<150> US 60/047,194
<151> 1997-05-20

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Pro Val Ser Val Val Lys Val Glu Cys Val Ala Ala Glu Val Ala Pro
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Asp Arg Gly Val Val Asp Lys Lys Pro Thr Ser Val Gly Val Pro Pro
65                  70                  75                  80
Gln Arg Gly Val Leu Ser Phe Pro Thr Val Val Arg Asn Arg Gly Asp
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Val Ile Ile Thr Gly Val Val His Glu Ala Leu Lys Lys Ile Lys Asp
            100                 105                 110
Gly Leu Leu Arg Phe Arg Val Gly Gly Asp Met Arg Phe Ser Arg Phe
        115                 120                 125
Phe Ser Ser Asn Tyr Gly Cys Arg Phe Val Ala Ser Val Arg Thr Asn
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Asp Gly Arg Cys Tyr Leu Ala His Met Arg Tyr Leu Cys Ala Phe Tyr
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Cys Arg Pro Phe Arg Glu Ser Asp Tyr Ala Leu Gly Met Trp Pro Thr
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Arg Phe Asp Lys Lys Arg Arg Met Cys Leu Pro Gly Tyr Asp Thr Ile
                    885                 890                 895
Tyr Leu Asp Ser Lys Phe Val Ser Arg Val Phe Asp Tyr Val Val Cys
                900                 905                 910
Asn Cys Ser Ala Val Asn Ser Lys Thr Phe Glu Trp Val Trp Ser Phe
                915                 920                 925
Ile Lys Ser Ser Lys Ser Arg Val Ile Ile Ser Gly Lys Ile Ile His
            930                 935                 940
Lys Asp Val Asn Leu Asp Leu Lys Tyr Val Glu Ser Phe Ala Ala Val
945                 950                 955                 960
Met Leu Ala Ser Gly Val Arg Ser Arg Leu Ala Ser Glu Tyr Leu Ala
                965                 970                 975
Lys Asn Leu Ser His Phe Ser Gly Asp Cys Ser Phe Ile Glu Ala Thr
                980                 985                 990
Ser Phe Val Leu Arg Glu Lys Ile Arg Asn Met Thr Leu Asn Phe Asn
                995                 1000                1005
Glu Arg Leu Leu Gln Leu Val Lys Arg Val Ala Phe Ala Thr Leu Asp
                1010                1015                1020
Val Ser Phe Leu Asp Leu Asp Ser Thr Leu Glu Ser Ile Thr Asp Phe
1025                1030                1035                1040
Ala Glu Cys Lys Val Ala Ile Glu Leu Asp Glu Leu Gly Cys Leu Arg
                    1045                1050                1055
Ala Glu Ala Glu Asn Glu Lys Ile Arg Asn Leu Ala Gly Asp Ser Ile
                1060                1065                1070
Ala Ala Lys Leu Ala Ser Glu Ile Val Val Asp Ile Asp Ser Lys Pro
                1075                1080                1085
Ser Pro Lys Gln Val Gly Asn Ser Ser Ser Glu Asn Ala Asp Lys Arg
                1090                1095                1100
Glu Val Gln Arg Pro Gly Leu Arg Gly Gly Ser Arg Asn Gly Val Val
1105                1110                1115                1120
Gly Glu Phe Leu His Phe Val Val Asp Ser Ala Leu Arg Leu Phe Lys
                    1125                1130                1135
Tyr Ala Thr Asp Gln Gln Arg Ile Lys Ser Tyr Val Arg Phe Leu Asp
            1140                1145                1150
Ser Ala Val Ser Phe Leu Asp Tyr Asn Tyr Asp Asn Leu Ser Phe Ile
                1155                1160                1165
Leu Arg Val Leu Ser Glu Gly Tyr Ser Cys Met Phe Ala Phe Leu Ala
            1170                1175                1180
Asn Arg Gly Asp Leu Ser Ser Arg Val Arg Ser Ala Val Cys Ala Val

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        1185                  1190                  1195                  1200
        Lys Glu Val Ala Thr Ser Cys Ala Asn Ala Ser Val Ser Lys Ala Lys
                        1205                  1210                  1215
        Val Met Ile Thr Phe Ala Ala Ala Val Cys Ala Met Met Phe Asn Ser
                        1220                  1225                  1230
        Cys Gly Phe Ser Gly Asp Gly Arg Glu Tyr Lys Ser Tyr Ile His Arg
                        1235                  1240                  1245
        Tyr Thr Gln Val Leu Phe Asp Thr Ile Phe Phe Glu Asp Ser Ser Tyr
                        1250                  1255                  1260
        Leu Pro Ile Glu Val Leu Ser Ser Ala Ile Cys Gly Ala Ile Val Thr
        1265                  1270                  1275                  1280
        Leu Phe Ser Ser Gly Ser Ser Ile Ser Leu Asn Ala Phe Leu Leu Gln
                        1285                  1290                  1295
        Ile Thr Lys Gly Phe Ser Leu Glu Val Val Val Arg Asn Val Val Arg
                        1300                  1305                  1310
        Val Thr His Gly Leu Ser Thr Thr Ala Thr Asp Gly Val Ile Arg Gly
                        1315                  1320                  1325
        Val Phe Ser Gln Ile Val Ser His Leu Leu Val Gly Asn Thr Gly Asn
                1330                  1335                  1340
        Val Ala Tyr Gln Ser Ala Phe Ile Ala Gly Val Val Pro Leu Leu Val
        1345                  1350                  1355                  1360
        Lys Lys Cys Val Ser Leu Ile Phe Ile Leu Arg Glu Asp Thr Tyr Ser
                        1365                  1370                  1375
        Gly Phe Ile Lys His Gly Ile Ser Glu Phe Ser Phe Leu Ser Ser Ile
                        1380                  1385                  1390
        Leu Lys Phe Leu Lys Gly Lys Leu Val Asp Glu Leu Lys Ser Ile Ile
                        1395                  1400                  1405
        Gln Gly Val Phe Asp Ser Asn Lys His Val Phe Lys Glu Ala Thr Gln
                1410                  1415                  1420
        Glu Ala Ile Arg Thr Thr Val Met Gln Val Pro Val Ala Val Val Asp
        1425                  1430                  1435                  1440
        Ala Leu Lys Ser Ala Ala Gly Lys Ile Tyr Asn Asn Phe Thr Ser Arg
                        1445                  1450                  1455
        Arg Thr Phe Gly Lys Asp Glu Gly Ser Ser Ser Asp Gly Ala Cys Glu
                1460                  1465                  1470
        Glu Tyr Phe Ser Cys Asp Glu Gly Glu Gly Pro Gly Leu Lys Gly Gly
                1475                  1480                  1485
        Ser Ser Tyr Gly Phe Ser Ile Leu Ala Phe Phe Ser Arg Ile Met Trp
                1490                  1495                  1500
        Gly Ala Arg Arg Leu Ile Val Lys Val Lys His Glu Cys Phe Gly Lys
        1505                  1510                  1515                  1520
        Leu Phe Glu Phe Leu Ser Leu Lys Leu His Glu Phe Arg Thr Arg Val
                        1525                  1530                  1535
        Phe Gly Lys Asn Arg Thr Asp Val Gly Val Tyr Asp Phe Leu Pro Thr
                1540                  1545                  1550
        Gly Ile Val Glu Thr Leu Ser Ser Ile Glu Glu Cys Asp Gln Ile Glu
                1555                  1560                  1565
        Glu Leu Leu Gly Asp Asp Leu Lys Gly Asp Lys Asp Ala Ser Leu Thr
                1570                  1575                  1580
        Asp Met Asn Tyr Phe Glu Phe Ser Glu Asp Phe Leu Ala Ser Ile Glu
        1585                  1590                  1595                  1600
        Glu Pro Pro Phe Ala Gly Leu Arg Gly Gly Ser Lys Asn Ile Ala Ile
                1605                  1610                  1615
        Leu Ala Ile Leu Glu Tyr Ala His Asn Leu Phe Arg Ile Val Ala Ser
                1620                  1625                  1630
        Lys Cys Ser Lys Arg Pro Leu Phe Leu Ala Phe Ala Glu Leu Ser Ser
                1635                  1640                  1645
        Ala Leu Ile Glu Lys Phe Lys Glu Val Phe Pro Arg Lys Ser Gln Leu
        1650                  1655                  1660
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Val Ala Ile Val Arg Glu Tyr Thr Gln Arg Phe Leu Arg Ser Arg Met
1665                1670                1675                1680
Arg Ala Leu Gly Leu Asn Asn Glu Phe Val Val Lys Ser Phe Ala Asp
                1685                1690                1695
Leu Leu Pro Ala Leu Met Lys Arg Lys Val Ser Gly Ser Phe Leu Ala
                1700                1705                1710
Ser Val Tyr Arg Pro Leu Arg Gly Phe Ser Tyr Met Cys Val Ser Ala
                1715                1720                1725
Glu Arg Arg Glu Lys Phe Phe Ala Leu Val Cys Leu Ile Gly Leu Ser
                1730                1735                1740
Leu Pro Phe Phe Val Arg Ile Val Gly Ala Lys Ala Cys Glu Glu Leu
1745                1750                1755                1760
Val Ser Ser Ala Arg Arg Phe Tyr Glu Arg Ile Lys Ile Phe Leu Arg
                1765                1770                1775
Gln Lys Tyr Val Ser Leu Ser Asn Phe Phe Cys His Leu Phe Ser Ser
                1780                1785                1790
Asp Val Asp Asp Ser Ser Ala Ser Ala Gly Leu Lys Gly Gly Ala Ser
                1795                1800                1805
Arg Met Thr Leu Phe His Leu Leu Val Arg Leu Ala Ser Ala Leu Leu
                1810                1815                1820
Ser Leu Gly Trp Glu Gly Leu Lys Leu Leu Leu Ser His His Asn Leu
1825                1830                1835                1840
Leu Phe Leu Cys Phe Ala Leu Val Asp Asp Val Asn Val Leu Ile Lys
                1845                1850                1855
Val Leu Gly Gly Leu Ser Phe Phe Val Gln Pro Ile Phe Ser Leu Phe
                1860                1865                1870
Ala Ala Met Leu Leu Gln Pro Asp Arg Phe Val Glu Tyr Ser Glu Lys
                1875                1880                1885
Leu Val Thr Ala Phe Glu Phe Phe Leu Lys Cys Ser Pro Arg Ala Pro
                1890                1895                1900
Ala Leu Leu Lys Gly Phe Phe Glu Cys Val Ala Asn Ser Thr Val Ser
1905                1910                1915                1920
Lys Thr Val Arg Arg Leu Leu Arg Cys Phe Val Lys Met Leu Lys Leu
                1925                1930                1935
Arg Lys Gly Arg Gly Leu Arg Ala Asp Gly Arg Gly Leu His Arg Gln
                1940                1945                1950
Lys Ala Val Pro Val Ile Pro Ser Asn Arg Val Val Thr Asp Gly Val
                1955                1960                1965
Glu Arg Leu Ser Val Lys Met Gln Gly Val Glu Ala Leu Arg Thr Glu
                1970                1975                1980
Leu Arg Ile Leu Glu Asp Leu Asp Ser Ala Val Ile Glu Lys Leu Asn
1985                1990                1995                2000
Arg Arg Arg Asn Arg Asp Thr Asn Asp Asp Glu Phe Thr Arg Pro Ala
                2005                2010                2015
His Glu Gln Met Gln Glu Val Thr Thr Phe Cys Ser Lys Ala Asn Ser
                2020                2025                2030
Ala Gly Leu Ala Leu Glu Arg Ala Val Leu Val Glu Asp Ala Ile Lys
                2035                2040                2045
Ser Glu Lys Leu Ser Lys Thr Val Asn Glu Met Val Arg Lys Gly Ser
                2050                2055                2060
Thr Thr Ser Glu Glu Val Ala Val Ala Leu Ser Asp Asp Glu Ala Val
2065                2070                2075                2080
Glu Glu Ile Ser Val Ala Asp Glu Arg Asp Asp Ser Pro Lys Thr Val
                2085                2090                2095
Arg Ile Ser Glu Tyr Leu Asn Arg Leu Asn Ser Ser Phe Glu Phe Pro
                2100                2105                2110
Lys Pro Ile Val Val Asp Asp Asn Lys Asp Thr Gly Gly Leu Thr Asn
                2115                2120                2125
Ala Val Arg Glu Phe Tyr Tyr Met Gln Glu Leu Ala Leu Phe Glu Ile
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          2130                   2135                    2140
His Ser Lys Leu Cys Thr Tyr Tyr Asp Gln Leu Arg Ile Val Asn Phe
2145                   2150                   2155                   2160
Asp Arg Ser Val Ala Pro Cys Ser Glu Asp Ala Gln Leu Tyr Val Arg
                      2165                   2170                   2175
Lys Asn Gly Ser Thr Ile Val Gln Gly Lys Glu Val Arg Leu His Ile
                      2180                   2185                   2190
Lys Asp Phe His Asp His Asp Phe Leu Phe Asp Gly Lys Ile Ser Ile
                      2195                   2200                   2205
Asn Lys Arg Arg Arg Gly Gly Asn Val Leu Tyr His Asp Asn Leu Ala
            2210                   2215                   2220
Phe Leu Ala Ser Asn Leu Phe Leu Ala Gly Tyr Pro Phe Ser Arg Ser
2225                   2230                   2235                   2240
Phe Val Phe Thr Asn Ser Ser Val Asp Ile Leu Leu Tyr Glu Ala Pro
                      2245                   2250                   2255
Pro Gly Gly Gly Lys Thr Thr Thr Leu Ile Asp Ser Phe Leu Lys Val
                      2260                   2265                   2270
Phe Lys Lys Gly Glu Val Ser Thr Met Ile Leu Thr Ala Asn Lys Ser
            2275                   2280                   2285
Ser Gln Val Glu Ile Leu Lys Lys Val Glu Lys Glu Val Ser Asn Ile
            2290                   2295                   2300
Glu Cys Gln Lys Arg Lys Asp Lys Arg Ser Pro Lys Lys Ser Ile Tyr
2305                   2310                   2315                   2320
Thr Ile Asp Ala Tyr Leu Met His His Arg Gly Cys Asp Ala Asp Val
                      2325                   2330                   2335
Leu Phe Ile Asp Glu Cys Phe Met Val His Ala Gly Ser Val Leu Ala
            2340                   2345                   2350
Cys Ile Glu Phe Thr Arg Cys His Lys Val Met Ile Phe Gly Asp Ser
            2355                   2360                   2365
Arg Gln Ile His Tyr Ile Glu Arg Asn Glu Leu Asp Lys Cys Leu Tyr
            2370                   2375                   2380
Gly Asp Leu Asp Arg Phe Val Asp Leu Gln Cys Arg Val Tyr Gly Asn
2385                   2390                   2395                   2400
Ile Ser Tyr Arg Cys Pro Trp Asp Val Cys Ala Trp Leu Ser Thr Val
                      2405                   2410                   2415
Tyr Gly Asn Leu Ile Ala Thr Val Lys Gly Glu Ser Glu Gly Lys Ser
            2420                   2425                   2430
Ser Met Arg Ile Asn Glu Ile Asn Ser Val Asp Asp Leu Val Pro Asp
            2435                   2440                   2445
Val Gly Ser Thr Phe Leu Cys Met Leu Gln Ser Glu Lys Leu Glu Ile
            2450                   2455                   2460
Ser Lys His Phe Ile Arg Lys Gly Leu Thr Lys Leu Asn Val Leu Thr
2465                   2470                   2475                   2480
Val His Glu Ala Gln Gly Glu Thr Tyr Ala Arg Val Asn Leu Val Arg
            2485                   2490                   2495
Leu Lys Phe Gln Glu Asp Glu Pro Phe Lys Ser Ile Arg His Ile Thr
            2500                   2505                   2510
Val Ala Leu Ser Arg His Thr Asp Ser Leu Thr Tyr Asn Val Leu Ala
            2515                   2520                   2525
Ala Arg Arg Gly Asp Ala Thr Cys Asp Ala Ile Gln Lys Ala Ala Glu
            2530                   2535                   2540
Leu Val Asn Lys Phe Arg Val Phe Pro Thr Ser Phe Gly Gly Ser Val
2545                   2550                   2555                   2560
Ile Asn Leu Asn Val Lys Lys Asp Val Glu Asp Asn Ser Arg Cys Lys
                      2565                   2570                   2575
Ala Ser Ser Ala Pro Leu Ser Val Ile Asn Asp Phe Leu Asn Glu Val
            2580                   2585                   2590
Asn Pro Gly Thr Ala Val Ile Asp Phe Gly Asp Leu Ser Ala Asp Phe
            2595                   2600                   2605
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Ser Thr Gly Pro Phe Glu Cys Gly Ala Ser Gly Ile Val Val Arg Asp
    2610              2615              2620
Asn Ile Ser Ser Ser Asn Ile Thr Asp His Asp Lys Gln Arg Val
2625              2630              2635


<210> 4
<211> 1380
<212> DNA
<213> Grapevine Leafroll Virus (type 2)

<400> 4
agcgtagttc ggtcgcaggc gattccgcgt agaaaacctt ctctacaaga aaatttgtat 60
tcgtttgaag cgcggaatta taacttctcg acttgcgacc gtaacacatc tgcttcaatg 120
ttcggagagg ctatggcgat gaactgtctt cgtcgttgct tcgacctaga tgccttttcg 180
tccctgcgtg atgatgtgat tagtatcaca cgttcaggca tcgaacaatg gctggagaaa 240
cgtactccta gtcagattaa agcattaatg aaggatgttg aatcgccttt ggaaattgac 300
gatgaaattt gtcgttttaa gttgatggtg aagcgtgacg ctaaggtgaa gttagactct 360
tcttgtttaa ctaaacacag cgccgctcaa aatatcatgt ttcatcgcaa gagcattaat 420
gctatcttct ctcctatctt taatgaggtg aaaaaccgaa taatgtgctg tcttaagcct 480
aacataaagt tttttacgga gatgactaac agggattttg cttctgttgt cagcaacatg 540
cttggtgacg acgatgtgta ccatataggt gaagttgatt tctcaaagta cgacaagtct 600
caagatgctt tcgtgaaggc ttttgaagaa gtaatgtata aggaactcgg tgttgatgaa 660
gagttgctgg ctatctggat gtgcggcgag cggttatcga tagctaacac tctcgatggt 720
cagttgtcct tcacgatcga gaatcaaagg aagtcgggag cttcgaacac ttggattggt 780
aactctctcg tcactttggg tattttaagt ctttactacg acgttagaaa tttcgaggcg 840
ttgtacatct cgggcgatga ttctttaatt ttttctcgca gcgagatttc gaattatgcc 900
gacgacatat gcactgacat gggtttgag acaaaattta tgtccccaag tgtcccgtac 960
ttttgttcta aatttgttgt tatgtgtggt cataagacgt tttttgttcc cgaccgtac 1020
aagctttttg tcaagttggg agcagtcaaa gaggatgttt caatggattt ccttttcgag 1080
acttttacct cctttaaaga cttaacctcc gattttaacg acgagcgctt aattcaaaag 1140
ctcgctgaac ttgtggcttt aaaatatgag gttcaaaccg gcaacaccac cttggcgtta 1200
agtgtgatac attgtttgcg ttcgaatttc ctctcgtttta gcaagttata tcctcgcgtg 1260
aagggatggc aggttttta cacgtcggtt aagaaagcgc ttctcaagag tgggtgttct 1320
ctcttcgaca gtttcatgac ccctttggt caggctgtca tggtttggga tgatgagtag 1380


<210> 5
<211> 459
<212> PRT
<213> Grapevine Leafroll Virus (type 2)

<400> 5
Ser Val Val Arg Ser Gln Ala Ile Pro Arg Arg Lys Pro Ser Leu Gln
1              5              10              15
Glu Asn Leu Tyr Ser Phe Glu Ala Arg Asn Tyr Asn Phe Ser Thr Cys
              20              25              30
Asp Arg Asn Thr Ser Ala Ser Met Phe Gly Glu Ala Met Ala Met Asn
              35              40              45
Cys Leu Arg Arg Cys Phe Asp Leu Asp Ala Phe Ser Ser Leu Arg Asp
      50              55              60
Asp Val Ile Ser Ile Thr Arg Ser Gly Ile Glu Gln Trp Leu Glu Lys
65              70              75              80
Arg Thr Pro Ser Gln Ile Lys Ala Leu Met Lys Asp Val Glu Ser Pro
              85              90              95
Leu Glu Ile Asp Asp Glu Ile Cys Arg Phe Lys Leu Met Val Lys Arg
              100             105             110
Asp Ala Lys Val Lys Leu Asp Ser Ser Cys Leu Thr Lys His Ser Ala
      115             120             125

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```
Ala Gln Asn Ile Met Phe His Arg Lys Ser Ile Asn Ala Ile Phe Ser
    130                 135                 140
Pro Ile Phe Asn Glu Val Lys Asn Arg Ile Met Cys Cys Leu Lys Pro
145                 150                 155                 160
Asn Ile Lys Phe Phe Thr Glu Met Thr Asn Arg Asp Phe Ala Ser Val
                165                 170                 175
Val Ser Asn Met Leu Gly Asp Asp Asp Val Tyr His Ile Gly Glu Val
            180                 185                 190
Asp Phe Ser Lys Tyr Asp Lys Ser Gln Asp Ala Phe Val Lys Ala Phe
            195                 200                 205
Glu Glu Val Met Tyr Lys Glu Leu Gly Val Asp Glu Glu Leu Leu Ala
    210                 215                 220
Ile Trp Met Cys Gly Glu Arg Leu Ser Ile Ala Asn Thr Leu Asp Gly
225                 230                 235                 240
Gln Leu Ser Phe Thr Ile Glu Asn Gln Arg Lys Ser Gly Ala Ser Asn
                245                 250                 255
Thr Trp Ile Gly Asn Ser Leu Val Thr Leu Gly Ile Leu Ser Leu Tyr
                260                 265                 270
Tyr Asp Val Arg Asn Phe Glu Ala Leu Tyr Ile Ser Gly Asp Asp Ser
            275                 280                 285
Leu Ile Phe Ser Arg Ser Glu Ile Ser Asn Tyr Ala Asp Asp Ile Cys
    290                 295                 300
Thr Asp Met Gly Phe Glu Thr Lys Phe Met Ser Pro Ser Val Pro Tyr
305                 310                 315                 320
Phe Cys Ser Lys Phe Val Val Met Cys Gly His Lys Thr Phe Phe Val
                325                 330                 335
Pro Asp Pro Tyr Lys Leu Phe Val Lys Leu Gly Ala Val Lys Glu Asp
            340                 345                 350
Val Ser Met Asp Phe Leu Phe Glu Thr Phe Thr Ser Phe Lys Asp Leu
    355                 360                 365
Thr Ser Asp Phe Asn Asp Glu Arg Leu Ile Gln Lys Leu Ala Glu Leu
    370                 375                 380
Val Ala Leu Lys Tyr Glu Val Gln Thr Gly Asn Thr Thr Leu Ala Leu
385                 390                 395                 400
Ser Val Ile His Cys Leu Arg Ser Asn Phe Leu Ser Phe Ser Lys Leu
                405                 410                 415
Tyr Pro Arg Val Lys Gly Trp Gln Val Phe Tyr Thr Ser Val Lys Lys
            420                 425                 430
Ala Leu Leu Lys Ser Gly Cys Ser Leu Phe Asp Ser Phe Met Thr Pro
            435                 440                 445
Phe Gly Gln Ala Val Met Val Trp Asp Asp Glu
    450                 455
```

```
<210> 6
<211> 171
<212> DNA
<213> Grapevine Leafroll Virus (type 2)

<400> 6
atgaatcagg ttttgcagtt tgaatgtttg tttctgctga atctcgcggt ttttgctgtg 60
actttcattt tcattcttct ggtcttccgc gtgattaagt cttttcgcca gaagggtcac 120
gaagcacctg ttcccgttgt tcgtggcggg ggttttttcaa ccgtagtgta g         171

<210> 7
<211> 56
<212> PRT
<213> Grapevine Leafroll Virus (type 2)
```

<400> 7
Met Asn Gln Val Leu Gln Phe Glu Cys Leu Phe Leu Leu Asn Leu Ala
1               5                   10                  15
Val Phe Ala Val Thr Phe Ile Phe Ile Leu Leu Val Phe Arg Val Ile
            20                  25                  30
Lys Ser Phe Arg Gln Lys Gly His Glu Ala Pro Val Pro Val Val Arg
            35                  40                  45
Gly Gly Gly Phe Ser Thr Val Val
            50                  55


<210> 8
<211> 1800
<212> DNA
<213> Grapevine Leafroll Virus (type 2)

<400> 8
atggtagttt tcggtttgga ctttggcacc acattctcta cggtgtgtgt gtacaaggat 60
ggacgagttt tttcattcaa gcagaataat tcggcgtaca tccccactta cctctatctc 120
ttctccgatt ctaaccacat gactttggt tacgaggccg aatcactgat gagtaatctg 180
aaagttaaag gttcgtttta tagagattta aaacgttggg tgggttgcga ttcgagtaac 240
ctcgacgcgt accttgaccg tttaaaacct cattactcgg tccgcttggt taagatcggc 300
tctggcttga acgaaactgt ttcaattgga aacttcgggg gcactgttaa gtctgaggct 360
catctgccag ggttgatagc tctctttatt aaggctgtca ttagttgcgc ggagggcgcg 420
tttgcgtgca cttgcaccgg ggttatttgt tcagtacctg ccaattatga tagcgttcaa 480
aggaatttca ctgatcagtg tgtttcactc agcggttatc agtgcgtata tatgatcaat 540
gaaccttcag cggctgcgct atctgcgtgt aattcgattg gaaagaagtc cgcaaatttg 600
gctgtttacg atttcggtgg tgggaccttc gacgtgtcta tcatttcata ccgcaacaat 660
acttttgttg tgcgagcttc tggaggcgat ctaaatctcg gtggaaggga tgttgatcgt 720
gcgtttctca cgcacctctt ctctttaaca tcgctggaac ctgacctcac tttggatatc 780
tcgaatctga aagaatcttt atcaaaaacg gacgcagaga tagtttacac tttgagaggt 840
gtcgatggaa gaaaagaaga cgttagagta aacaaaaaca ttcttacgtc ggtgatgctc 900
ccctacgtga acagaacgct taagatatta gagtcaacct aaaatcgta tgctaagagt 960
atgaatgaga gtgcgcgagt taagtgcgat ttagtgctga taggaggatc ttcatatctt 1020
cctggcctgg cagacgtact aacgaagcat cagagcgttg atcgtatctt aagagtttcg 1080
gatcctcggg ctgccgtggc cgtcggttgc gcattatatt cttcatgcct ctcaggatct 1140
ggggggttgc tactgatcga ctgtgcagct cacactgtcg ctatagcgga cagaagttgt 1200
catcaaatca tttgcgctcc agcggggggca ccgatcccct tttcaggaag catgcctttg 1260
tacttagcca gggtcaacaa gaactcgcag cgtgaagtcg ccgtgtttga agggagtac 1320
gttaagtgcc ctaagaacag aaagatctgt ggagcaaata taagattttt tgatatagga 1380
gtgacgggtg attcgtacgc acccgttacc ttctatatgg atttctccat ttcaagcgta 1440
ggagccgttt cattcgtggt gagaggtcct gagggtaagc aagtgtcact cactggaact 1500
ccagcgtata acttttcgtc tgtggctctc ggatcacgca gtgtccgaga attgcatatt 1560
agtttaaata ataaagtttt tctcggtttg cttctacata gaaaggcgga tcgacgaata 1620
cttttcacta aggatgaagc gattcgatac gccgattcaa ttgatatcgc ggatgtgcta 1680
aaggaatata aaagttacgc ggccagtgcc ttaccaccag acgaggatgt cgaattactc 1740
ctgggaaagt ctgttcaaaa agttttacgg ggaagcagac tggaagaaat acctctctag 1800


<210> 9
<211> 599
<212> PRT
<213> Grapevine Leafroll Virus (type 2)

<400> 9
Met Val Val Phe Gly Leu Asp Phe Gly Thr Thr Phe Ser Thr Val Cys
1               5                   10                  15
Val Tyr Lys Asp Gly Arg Val Phe Ser Phe Lys Gln Asn Asn Ser Ala
            20                  25                  30

```
Tyr Ile Pro Thr Tyr Leu Tyr Leu Phe Ser Asp Ser Asn His Met Thr
        35              40                  45
Phe Gly Tyr Glu Ala Glu Ser Leu Met Ser Asn Leu Lys Val Lys Gly
    50              55                  60
Ser Phe Tyr Arg Asp Leu Lys Arg Trp Val Gly Cys Asp Ser Ser Asn
65              70                  75                      80
Leu Asp Ala Tyr Leu Asp Arg Leu Lys Pro His Tyr Ser Val Arg Leu
                85                  90                  95
Val Lys Ile Gly Ser Gly Leu Asn Glu Thr Val Ser Ile Gly Asn Phe
            100                 105                 110
Gly Gly Thr Val Lys Ser Glu Ala His Leu Pro Gly Leu Ile Ala Leu
            115                 120                 125
Phe Ile Lys Ala Val Ile Ser Cys Ala Glu Gly Ala Phe Ala Cys Thr
    130                 135                 140
Cys Thr Gly Val Ile Cys Ser Val Pro Ala Asn Tyr Asp Ser Val Gln
145                 150                 155                 160
Arg Asn Phe Thr Asp Gln Cys Val Ser Leu Ser Gly Tyr Gln Cys Val
                165                 170                 175
Tyr Met Ile Asn Glu Pro Ser Ala Ala Ala Leu Ser Ala Cys Asn Ser
            180                 185                 190
Ile Gly Lys Lys Ser Ala Asn Leu Ala Val Tyr Asp Phe Gly Gly Gly
            195                 200                 205
Thr Phe Asp Val Ser Ile Ile Ser Tyr Arg Asn Asn Thr Phe Val Val
    210                 215                 220
Arg Ala Ser Gly Gly Asp Leu Asn Leu Gly Gly Arg Asp Val Asp Arg
225                 230                 235                 240
Ala Phe Leu Thr His Leu Phe Ser Leu Thr Ser Leu Glu Pro Asp Leu
                245                 250                 255
Thr Leu Asp Ile Ser Asn Leu Lys Glu Ser Leu Ser Lys Thr Asp Ala
                260                 265                 270
Glu Ile Val Tyr Thr Leu Arg Gly Val Asp Gly Arg Lys Glu Asp Val
            275                 280                 285
Arg Val Asn Lys Asn Ile Leu Thr Ser Val Met Leu Pro Tyr Val Asn
    290                 295                 300
Arg Thr Leu Lys Ile Leu Glu Ser Thr Leu Lys Ser Tyr Ala Lys Ser
305                 310                 315                 320
Met Asn Glu Ser Ala Arg Val Lys Cys Asp Leu Val Leu Ile Gly Gly
            325                 330                 335
Ser Ser Tyr Leu Pro Gly Leu Ala Asp Val Leu Thr Lys His Gln Ser
            340                 345                 350
Val Asp Arg Ile Leu Arg Val Ser Asp Pro Arg Ala Ala Val Ala Val
        355                 360                 365
Gly Cys Ala Leu Tyr Ser Ser Cys Leu Ser Gly Ser Gly Gly Leu Leu
370                 375                 380
Leu Ile Asp Cys Ala Ala His Thr Val Ala Ile Ala Asp Arg Ser Cys
385                 390                 395                 400
His Gln Ile Ile Cys Ala Pro Ala Gly Ala Pro Ile Pro Phe Ser Gly
                405                 410                 415
Ser Met Pro Leu Tyr Leu Ala Arg Val Asn Lys Asn Ser Gln Arg Glu
            420                 425                 430
Val Ala Val Phe Glu Gly Glu Tyr Val Lys Cys Pro Lys Asn Arg Lys
            435                 440                 445
Ile Cys Gly Ala Asn Ile Arg Phe Phe Asp Ile Gly Val Thr Gly Asp
    450                 455                 460
Ser Tyr Ala Pro Val Thr Phe Tyr Met Asp Phe Ser Ile Ser Ser Val
465                 470                 475                 480
Gly Ala Val Ser Phe Val Val Arg Gly Pro Glu Gly Lys Gln Val Ser
                485                 490                 495
Leu Thr Gly Thr Pro Ala Tyr Asn Phe Ser Ser Val Ala Leu Gly Ser
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                500                    505                    510
Arg Ser Val Arg Glu Leu His Ile Ser Leu Asn Asn Lys Val Phe Leu
            515                    520                    525
Gly Leu Leu Leu His Arg Lys Ala Asp Arg Arg Ile Leu Phe Thr Lys
            530                    535                    540
Asp Glu Ala Ile Arg Tyr Ala Asp Ser Ile Asp Ile Ala Asp Val Leu
545                    550                    555                    560
Lys Glu Tyr Lys Ser Tyr Ala Ala Ser Ala Leu Pro Pro Asp Glu Asp
                565                    570                    575
Val Glu Leu Leu Leu Gly Lys Ser Val Gln Lys Val Leu Arg Gly Ser
            580                    585                    590
Arg Leu Glu Glu Ile Pro Leu
            595
```

<210> 10
<211> 1656
<212> DNA
<213> Grapevine Leafroll Virus (type 2)

<400> 10

```
atgtcgaatt actcctggga aagtctgttc aaaaagtttt acggggaagc agactggaag 60
aaatacctct ctaggagcat agcagcacac tcaagtgaaa ttaaaactct accagacatt 120
cgattgtacg gcggtagggt tgtaaagaag tccgaattcg aatcagcact tcctaattct 180
tttgaacagg aattaggact gttcatactg agcgaacggg aagtgggatg gagcaaatta 240
tgcggaataa cggtggaaga agcagcatac gatcttacga atcccaaggc ttataaattc 300
actgccgaga catgtagccc ggatgtaaaa ggtgaaggac aaaaatactc tatggaagac 360
gtgatgaatt tcatgcgttt atcaaatctg gatgttaacg acaagatgct gacggaacag 420
tgttggtcgc tgtccaattc atgcggtgaa ttgatcaacc cagacgacaa agggcgattc 480
gtggctctca cctttaagga cagagacaca gctgatgaca cgggtgccgc caacgtggaa 540
tgtcgcgtgg cgactatct agtttacgct atgtccctgt ttgagcagag gacccaaaaa 600
tcgcagtctg caacatctc tctgtacgaa aagtactgtg aatacatcag gacctactta 660
gggagtacag acctgttctt cacagcgccg gacaggattc cgttacttac gggcatccta 720
tacgatttt gtaaggaata caacgttttc tactcgtcat ataagagaaa cgtcgataat 780
ttcagattct tcttggcgaa ttatatgcct ttgatatctg acgtctttgt cttccagtgg 840
gtaaaacccg cgccggatgt tcggctgctt tttgagttaa gtgcagcgga actaacgctg 900
gaggttccca cactgagttt gatagattct caagttgtgg taggtcatat cttaagatac 960
gtagaatcct acacatcaga tccagccatc gacgcgttag aagacaaact ggaagcgata 1020
ctgaaaagta gcaatccccg tctatcgaca gcgcaactat gggttggttt cttttgttac 1080
tatggtgagt ttcgtacggc tcaaagtaga gtagtgcaaa gaccaggcgt atacaaaaca 1140
cctgactcag tgggtggatt tgaaataaac atgaaagatg ttgagaaatt cttcgataaa 1200
cttcagagag aattgcctaa tgtatctttg cggcgtcagt ttaacggagc tagagcgcat 1260
gaggctttca aaatatttaa aaacggaaat ataagtttca gacctatatc gcgtttaaac 1320
gtgcctagag agttctggta tctgaacata gactacttca ggcacgcgaa taggtccggg 1380
ttaaccgaag aagaaatact catcctaaac aacataagcg ttgatgttag gaagttatgc 1440
gctgagagag cgtgcaatac cctacctagc gcgaagcgct ttagtaaaaa tcataagagt 1500
aatatacaat catcacgcca agagcggagg attaaagacc cattggtagt cctgaaagac 1560
actttatatg agttccaaca caagcgtgcc ggttgggggt ctcgaagcac tcgagacctc 1620
gggagtcgtg ctgaccacgc gaaaggaagc ggttga 1656
```

<210> 11
<211> 551
<212> PRT
<213> Grapevine Leafroll Virus (type 2)

<400> 11

```
Met Ser Asn Tyr Ser Trp Glu Ser Leu Phe Lys Lys Phe Tyr Gly Glu
1               5                   10                  15
Ala Asp Trp Lys Lys Tyr Leu Ser Arg Ser Ile Ala Ala His Ser Ser
```

```
                20                          25                          30
Glu Ile Lys Thr Leu Pro Asp Ile Arg Leu Tyr Gly Gly Arg Val Val
        35                          40                          45
Lys Lys Ser Glu Phe Glu Ser Ala Leu Pro Asn Ser Phe Glu Gln Glu
        50                          55                          60
Leu Gly Leu Phe Ile Leu Ser Glu Arg Glu Val Gly Trp Ser Lys Leu
65                          70                          75                  80
Cys Gly Ile Thr Val Glu Glu Ala Ala Tyr Asp Leu Thr Asn Pro Lys
Ala Tyr Lys Phe Thr Ala Glu Thr Cys Ser Pro Asp Val Lys Gly Glu
        85                          90                          95
Gly Gln Lys Tyr Ser Met Glu Asp Val Met Asn Phe Met Arg Leu Ser
        100                         105                         110
Asn Leu Asp Val Asn Asp Lys Met Leu Thr Glu Gln Cys Trp Ser Leu
        115                         120                         125
Ser Asn Ser Cys Gly Glu Leu Ile Asn Pro Asp Asp Lys Gly Arg Phe
        130                         135                         140
Val Ala Leu Thr Phe Lys Asp Arg Asp Thr Ala Asp Asp Thr Gly Ala
145                         150                         155                 160
Ala Asn Val Glu Cys Arg Val Gly Asp Tyr Leu Val Tyr Ala Met Ser
        165                         170                         175
Leu Phe Glu Gln Arg Thr Gln Lys Ser Gln Ser Gly Asn Ile Ser Leu
        180                         185                         190
Tyr Glu Lys Tyr Cys Glu Tyr Ile Arg Thr Tyr Leu Gly Ser Thr Asp
        195                         200                         205
Leu Phe Phe Thr Ala Pro Asp Arg Ile Pro Leu Leu Thr Gly Ile Leu
225                         210                         220
Tyr Asp Phe Cys Lys Glu Tyr Asn Val Phe Tyr Ser Ser Tyr Lys Arg
        230                         235                         240
Asn Val Asp Asn Phe Arg Phe Phe Leu Ala Asn Tyr Met Pro Leu Ile
        245                         250                         255
Ser Asp Val Phe Val Phe Gln Trp Val Lys Pro Ala Pro Asp Val Arg
        260                         265                         270
Leu Leu Phe Glu Leu Ser Ala Ala Glu Leu Thr Leu Glu Val Pro Thr
        275                         280                         285
Leu Ser Leu Ile Asp Ser Gln Val Val Val Gly His Ile Leu Arg Tyr
290                         295                         300
Val Glu Ser Tyr Thr Ser Asp Pro Ala Ile Asp Ala Leu Glu Asp Lys
305                         310                         315                 320
Leu Glu Ala Ile Leu Lys Ser Ser Asn Pro Arg Leu Ser Thr Ala Gln
        325                         330                         335
Leu Trp Val Gly Phe Phe Cys Tyr Tyr Gly Glu Phe Arg Thr Ala Gln
        340                         345                         350
Ser Arg Val Val Gln Arg Pro Gly Val Tyr Lys Thr Pro Asp Ser Val
        355                         360                         365
Gly Gly Phe Glu Ile Asn Met Lys Asp Val Glu Lys Phe Phe Asp Lys
        370                         375                         380
Leu Gln Arg Glu Leu Pro Asn Val Ser Leu Arg Arg Gln Phe Asn Gly
385                         390                         395                 400
Ala Arg Ala His Glu Ala Phe Lys Ile Phe Lys Asn Gly Asn Ile Ser
        405                         410                         415
Phe Arg Pro Ile Ser Arg Leu Asn Val Pro Arg Glu Phe Trp Tyr Leu
        420                         425                         430
Asn Ile Asp Tyr Phe Arg His Ala Asn Arg Ser Gly Leu Thr Glu Glu
        435                         440                         445
Glu Ile Leu Ile Leu Asn Asn Ile Ser Val Asp Val Arg Lys Leu Cys
        450                         455                         460
Ala Glu Arg Ala Cys Asn Thr Leu Pro Ser Ala Lys Arg Phe Ser Lys
465                         470                         475                 480
                485                         490                         495
```

```
Asn His Lys Ser Asn Ile Gln Ser Ser Arg Gln Glu Arg Arg Ile Lys
        500                 505                 510
Asp Pro Leu Val Val Leu Lys Asp Thr Leu Tyr Glu Phe Gln His Lys
        515                 520                 525
Arg Ala Gly Trp Gly Ser Arg Ser Thr Arg Asp Leu Gly Ser Arg Ala
        530                 535                 540
Asp His Ala Lys Gly Ser Gly
545                 550
```

<210> 12
<211> 672
<212> DNA
<213> Grapevine Leafroll Virus (type 2)

<400> 12
```
atgagttcca acacaagcgt gccggttggg ggtctcgaag cactcgagac ctcgggagtc 60
gtgctgacca cgcgaaagga agcggttgat aagtttttta atgaactaaa aaacgaaaat 120
tactcatcag ttgacagcag ccgattaagc gattcggaag taaaagaagt gttagagaaa 180
agtaaagaaa gtttcaaaag cgaactggcc tccactgacg agcacttcgt ctaccacatt 240
atattttct taatccgatg tgctaagata tcgacaagtg aaaagtgaa gtacgttggt 300
agtcatacgt acgtggtcga cggaaaaacg tacaccgttc ttgacgcttg ggtattcaac 360
atgatgaaaa gtctcacgaa gaagtacaaa cgagtgaatg gtctgcgtgc gttctgttgc 420
gcgtgcgaag atctatatct aaccgtcgca ccaataatgt cagaacgctt taagactaaa 480
gccgtaggga tgaaaggttt gcctgttgga aaggaatact taggcgccga ctttctttcg 540
ggaactagca aactgatgag cgatcacgac agggcggtct ccatcgttgc agcgaaaaac 600
gctgtcgatc gtagcgcttt cacgggtggg gagagaaaga tagttagttt gtatgatcta 660
gggaggtact aa                                                    672
```

<210> 13
<211> 223
<212> PRT
<213> Grapevine Leafroll Virus (type 2)

<400> 13
```
Met Ser Ser Asn Thr Ser Val Pro Val Gly Gly Leu Glu Ala Leu Glu
1               5                   10                  15
Thr Ser Gly Val Val Leu Thr Thr Arg Lys Glu Ala Val Asp Lys Phe
            20                  25                  30
Phe Asn Glu Leu Lys Asn Glu Asn Tyr Ser Ser Val Asp Ser Ser Arg
        35                  40                  45
Leu Ser Asp Ser Glu Val Lys Glu Val Leu Glu Lys Ser Lys Glu Ser
        50                  55                  60
Phe Lys Ser Glu Leu Ala Ser Thr Asp Glu His Phe Val Tyr His Ile
65                  70                  75                  80
Ile Phe Phe Leu Ile Arg Cys Ala Lys Ile Ser Thr Ser Glu Lys Val
                85                  90                  95
Lys Tyr Val Gly Ser His Thr Tyr Val Val Asp Gly Lys Thr Tyr Thr
            100                 105                 110
Val Leu Asp Ala Trp Val Phe Asn Met Met Lys Ser Leu Thr Lys Lys
        115                 120                 125
Tyr Lys Arg Val Asn Gly Leu Arg Ala Phe Cys Cys Ala Cys Glu Asp
    130                 135                 140
Leu Tyr Leu Thr Val Ala Pro Ile Met Ser Glu Arg Phe Lys Thr Lys
145                 150                 155                 160
Ala Val Gly Met Lys Gly Leu Pro Val Gly Lys Glu Tyr Leu Gly Ala
                165                 170                 175
Asp Phe Leu Ser Gly Thr Ser Lys Leu Met Ser Asp His Asp Arg Ala
            180                 185                 190
```

```
Val Ser Ile Val Ala Ala Lys Asn Ala Val Asp Arg Ser Ala Phe Thr
        195                 200                 205
Gly Gly Glu Arg Lys Ile Val Ser Leu Tyr Asp Leu Gly Arg Tyr
    210                 215                 220
```

```
<210> 14
<211> 597
<212> DNA
<213> Grapevine Leafroll Virus (type 2)

<400> 14
atggagttga tgtccgacag caaccttagc aacctggtga taaccgacgc ctctagtcta 60
aatggtgtcg acaagaagct tttatctgct gaagttgaaa aaatgttggt gcagaaaggg 120
gctcctaacg agggtataga agtggtgttc ggtctactcc tttacgcact cgcggcaaga 180
accacgtctc ctaaggttca gcgcgcagat tcagacgtta tattttcaaa tagtttcgga 240
gagaggaatg tggtagtaac agagggtgac cttaagaagg tactcgacgg gtgtgcgcct 300
gacttttgta tcgcgtataa gcacaaatta ccccaactca acgccgcggc ggaattgggg 420
gaattacagc aaagtaggaa gatgttcgcg agtatgtacg ctctaaaaac tgaaggtgga 540
gtggtaaata caccagtgag caatctgcgt cagctaggta gaagggaagt tatgtaa    597
```

```
<210> 15
<211> 198
<212> PRT
<213> Grapevine Leafroll Virus (type 2)

<400> 15
Met Glu Leu Met Ser Asp Ser Asn Leu Ser Asn Leu Val Ile Thr Asp
  1               5                  10                  15
Ala Ser Ser Leu Asn Gly Val Asp Lys Lys Leu Leu Ser Ala Glu Val
              20                  25                  30
Glu Lys Met Leu Val Gln Lys Gly Ala Pro Asn Glu Gly Ile Glu Val
          35                  40                  45
Val Phe Gly Leu Leu Leu Tyr Ala Leu Ala Ala Arg Thr Thr Ser Pro
      50                  55                  60
Lys Val Gln Arg Ala Asp Ser Asp Val Ile Phe Ser Asn Ser Phe Gly
  65                  70                  75                  80
Glu Arg Asn Val Val Val Thr Glu Gly Asp Leu Lys Lys Val Leu Asp
              85                  90                  95
Gly Cys Ala Pro Leu Thr Arg Phe Thr Asn Lys Leu Arg Thr Phe Gly
             100                 105                 110
Arg Thr Phe Thr Glu Ala Tyr Val Asp Phe Cys Ile Ala Tyr Lys His
         115                 120                 125
Lys Leu Pro Gln Leu Asn Ala Ala Ala Glu Leu Gly Ile Pro Ala Glu
         130                 135                 140
Asp Ser Tyr Leu Ala Ala Asp Phe Leu Gly Thr Cys Pro Lys Leu Ser
145                 150                 155                 160
Glu Leu Gln Gln Ser Arg Lys Met Phe Ala Ser Met Tyr Ala Leu Lys
                 165                 170                 175
Thr Glu Gly Gly Val Val Asn Thr Pro Val Ser Asn Leu Arg Gln Leu
             180                 185                 190
Gly Arg Arg Glu Val Met
         195
```

```
<210> 16
<211> 486
```

<212> DNA
<213> Grapevine Leafroll Virus (type 2)

<400> 16
atggaagatt acgaagaaaa atccgaatcg ctcatactgc tacgcacgaa tctgaacact 60
atgctttag tggtcaagtc cgatgctagt gtagagctgc ctaaactact aatttgcggt 120
tacttacgag tgtcaggacg tggggaggtg acgtgttgca accgtgagga attaacaaga 180
gattttgagg gcaatcatca tacggtgatc cgttctagaa tcatacaata tgacagcgag 240
tctgctttg aggaattcaa caactctgat tgcgtagtga agttttcct agagactggt 300
agtgtctttt ggttttcct tcgaagtgaa accaaaggta gagcggtgcg acatttgcgc 360
accttcttcg aagctaacaa tttcttcttt ggatcgcatt gcggtaccat ggagtattgt 420
ttgaagcagg tactaactga aactgaatct ataatcgatt ctttttgcga agaaagaaat 480
cgttaa                                                         486

<210> 17
<211> 161
<212> PRT
<213> Grapevine Leafroll Virus (type 2)

<400> 17
Met Glu Asp Tyr Glu Glu Lys Ser Glu Ser Leu Ile Leu Leu Arg Thr
1               5                   10                  15
Asn Leu Asn Thr Met Leu Leu Val Val Lys Ser Asp Ala Ser Val Glu
            20                  25                  30
Leu Pro Lys Leu Leu Ile Cys Gly Tyr Leu Arg Val Ser Gly Arg Gly
        35                  40                  45
Glu Val Thr Cys Cys Asn Arg Glu Glu Leu Thr Arg Asp Phe Glu Gly
    50                  55                  60
Asn His His Thr Val Ile Arg Ser Arg Ile Ile Gln Tyr Asp Ser Glu
65                  70                  75                  80
Ser Ala Phe Glu Glu Phe Asn Asn Ser Asp Cys Val Val Lys Phe Phe
                85                  90                  95
Leu Glu Thr Gly Ser Val Phe Trp Phe Phe Leu Arg Ser Glu Thr Lys
            100                 105                 110
Gly Arg Ala Val Arg His Leu Arg Thr Phe Phe Glu Ala Asn Asn Phe
        115                 120                 125
Phe Phe Gly Ser His Cys Gly Thr Met Glu Tyr Cys Leu Lys Gln Val
    130                 135                 140
Leu Thr Glu Thr Glu Ser Ile Ile Asp Ser Phe Cys Glu Glu Arg Asn
145                 150                 155
Arg                                                         160


<210> 18
<211> 618
<212> DNA
<213> Grapevine Leafroll Virus (type 2)

<400> 18
atgagggtta tagtgtctcc ttatgaagct gaagacattc tgaaaagatc gactgacatg 60
ttacgaaaca tagacagtgg ggtcttgagc actaaagaat gtatcaaggc attctcgacg 120
ataacgcgag acctacattg tgcgaaggct tcctaccagt ggggtgttga cactgggtta 180
gctcaacctc tcgtgcgtga aaaagtggcg attgacacgg tggagtcaaa catacggttg 240
ctagtagcat tcatcacgcg aaagtacgtg gaactcacgg gcgtgggagt gagagaagcg 300
gtgaagaggg aaatgcgctc tcttaccaaa acagttttaa ataaaatgtc tttggaaatg 360
gcgttttaca tgtcaccacg agcgtggaaa aacgctgaat ggttagaact aaaattttca 420
cctgtgaaaa tctttagaga tctgctatta gacgtggaaa cgctcaacga attgtgcgcc 540

```
gaagatgatg ttcacgtcga caaagtaaat gagaatgggg acgaaaatca cgacctcgaa 600
ctccaagacg aatgttaa                                                618
```

<210> 19
<211> 205
<212> PRT
<213> Grapevine Leafroll Virus (type 2)

<400> 19

```
Met Arg Val Ile Val Ser Pro Tyr Glu Ala Glu Asp Ile Leu Lys Arg
 1               5                  10                  15
Ser Thr Asp Met Leu Arg Asn Ile Asp Ser Gly Val Leu Ser Thr Lys
            20                  25                  30
Glu Cys Ile Lys Ala Phe Ser Thr Ile Thr Arg Asp Leu His Cys Ala
        35                  40                  45
Lys Ala Ser Tyr Gln Trp Gly Val Asp Thr Gly Leu Tyr Gln Arg Asn
    50                  55                  60
Cys Ala Glu Lys Arg Leu Ile Asp Thr Val Glu Ser Asn Ile Arg Leu
65                  70                  75                  80
Ala Gln Pro Leu Val Arg Glu Lys Val Ala Val His Phe Cys Lys Asp
                85                  90                  95
Glu Pro Lys Glu Leu Val Ala Phe Ile Thr Arg Lys Tyr Val Glu Leu
            100                 105                 110
Thr Gly Val Gly Val Arg Glu Ala Val Lys Arg Glu Met Arg Ser Leu
        115                 120                 125
Thr Lys Thr Val Leu Asn Lys Met Ser Leu Glu Met Ala Phe Tyr Met
        130                 135                 140
Ser Pro Arg Ala Trp Lys Asn Ala Glu Trp Leu Glu Leu Lys Phe Ser
145                 150                 155                 160
Pro Val Lys Ile Phe Arg Asp Leu Leu Leu Asp Val Glu Thr Leu Asn
                165                 170                 175
Glu Leu Cys Ala Glu Asp Asp Val His Val Asp Lys Val Asn Glu Asn
            180                 185                 190
Gly Asp Glu Asn His Asp Leu Glu Leu Gln Asp Glu Cys
        195                 200                 205
```

<210> 20
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<223> Artificially Synthesized Oligonucleotide Sequence

<400> 20
```
tgctggagct tgaggttctg c                                            21
```

<210> 21
<211> 31
<212> DNA
<213> Artificial Sequence

<220>
<223> Artificially Synthesized Oligonucleotide Sequence

<400> 21
```
cggaattcac catggagttg atgtccgaca g                                 31
```

<210> 22
<211> 33
<212> DNA
<213> Artificial Sequence

<220>
<223> Artificially Synthesized Oligonucleotide Sequence

<400> 22
agcggatcca tggcagattc gtgcgtagca gta                                    33

<210> 23
<211> 216
<212> DNA
<213> Grapevine Leafroll Virus (type 2)

<400> 23
acattggtta agtttaacga aaatgattag taaataataa atcgaacgtg ggtgtatcta 60
cctgacgtat caacttaagc tgttactgag taattaaacc aacaagtgtt ggtgtaatgt 120
gtatgttgat gtagagaaaa atccgtttgt agaacggtgt ttttctcttc tttatttta 180
aaaaaaaaat aaaaaaaaaa aaaaaaagc ggccgc                                216

<210> 24
<211> 90
<212> PRT
<213> Beet Yellows Virus

<400> 24

Leu Gln Tyr Arg Pro Gly Glu Gly Leu Cys Tyr Leu Ala His Ala Ala
1               5                   10                  15
Leu Cys Cys Ala Leu Gln Lys Arg Thr Phe Arg Glu Glu Asp Phe Phe
                20                  25                  30
Val Gly Met Tyr Pro Thr Lys Phe Val Phe Ala Lys Arg Leu Thr Glu
        35                  40                  45
Lys Leu Gly Pro Ser Ala Leu Lys His Pro Val Arg Gly Arg Gln Val
    50                  55                  60
Ser Arg Ser Leu Phe His Cys Asp Val Ala Ser Ala Phe Ser Ser Pro
65                  70                  75                  80
Phe Tyr Ser Leu Pro Arg Phe Ile Gly Gly
                85                  90

<210> 25
<211> 267
<212> PRT
<213> Beet Yellows Virus

<400> 25

Met Gly Glu Ala Val Gln Ser Gly Leu Thr Arg Ala Tyr Pro Gln Phe
1               5                   10                  15
Asn Leu Ser Phe Thr His Ser Val Tyr Ser Asp His Pro Ala Ala Ala
                20                  25                  30
Gly Ser Arg Leu Leu Glu Asn Glu Thr Leu Ala Ser Met Ala Lys Ser
        35                  40                  45
Ser Phe Ser Asp Ile Gly Gly Cys Pro Leu Phe His Ile Lys Arg Gly
    50                  55                  60
Ser Thr Asp Tyr His Val Cys Arg Pro Ile Tyr Asp Met Lys Asp Ala
65                  70                  75                  80
Gln Arg Arg Val Ser Arg Glu Leu Gln Ala Arg Gly Leu Val Glu Asn

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```
                      85                      90                      95
Leu Ser Arg Glu Gln Leu Val Glu Ala Gln Ala Arg Val Ser Val Cys
                100                     105                     110
Pro His Thr Leu Gly Asn Cys Asn Val Lys Ser Asp Val Leu Ile Met
                115                     120                     125
Val Gln Val Tyr Asp Ala Ser Leu Asn Glu Ile Ala Ser Ala Met Val
            130                     135                     140
Leu Lys Glu Ser Lys Val Ala Tyr Leu Thr Met Val Thr Pro Gly Glu
145                     150                     155                     160
Leu Leu Asp Glu Arg Glu Ala Phe Ala Ile Asp Ala Leu Gly Cys Asp
                165                     170                     175
Val Val Val Asp Thr Arg Arg Asp Met Val Gln Tyr Lys Phe Gly Ser
            180                     185                     190
Ser Cys Tyr Cys His Lys Leu Ser Asn Ile Lys Ser Ile Met Leu Thr
        195                     200                     205
Pro Ala Phe Thr Phe Ser Gly Asn Leu Phe Ser Val Glu Met Tyr Glu
    210                     215                     220
Asn Arg Met Gly Val Asn Tyr Tyr Lys Ile Thr Arg Ser Ala Tyr Ser
225                     230                     235                     240
Pro Glu Ile Arg Gly Val Lys Thr Leu Arg Tyr Arg Arg Ala Cys Thr
                245                     250                     255
Glu Val Val Gln Val Lys Leu Pro Arg Phe Asp
                260                     265
```

<210> 26
<211> 316
<212> PRT
<213> Beet Yellows VIrus

<400> 26
```
Phe Thr Phe Thr Asn Leu Ser Ala Asn Val Leu Leu Tyr Glu Ala Pro
1               5                       10                      15
Pro Gly Gly Gly Lys Thr Thr Thr Leu Ile Lys Val Phe Cys Glu Thr
            20                      25                      30
Phe Ser Lys Val Asn Ser Leu Ile Leu Thr Ala Asn Lys Ser Ser Arg
        35                      40                      45
Glu Glu Ile Leu Ala Lys Val Asn Arg Ile Val Leu Asp Glu Gly Asp
    50                      55                      60
Thr Pro Leu Gln Thr Arg Asp Arg Ile Leu Thr Ile Asp Ser Tyr Leu
65                      70                      75                      80
Met Asn Asn Arg Gly Leu Thr Cys Lys Val Leu Tyr Leu Asp Glu Cys
                85                      90                      95
Phe Met Val His Ala Gly Ala Ala Val Ala Cys Ile Glu Phe Thr Lys
                100                     105                     110
Cys Asp Ser Ala Ile Leu Phe Gly Asp Ser Arg Gln Ile Arg Tyr Gly
        115                     120                     125
Arg Cys Ser Glu Leu Asp Thr Ala Val Leu Ser Asp Leu Asn Arg Phe
    130                     135                     140
Val Asp Asp Glu Ser Arg Val Tyr Gly Glu Val Ser Tyr Arg Cys Pro
145                     150                     155                     160
Trp Asp Val Cys Ala Trp Leu Ser Thr Phe Tyr Pro Lys Thr Val Ala
                165                     170                     175
Thr Thr Asn Leu Val Ser Ala Gly Gln Ser Ser Met Gln Val Arg Glu
            180                     185                     190
Ile Glu Ser Val Asp Asp Val Glu Tyr Ser Ser Glu Phe Val Tyr Leu
        195                     200                     205
Thr Met Leu Gln Ser Glu Lys Lys Asp Leu Leu Lys Ser Phe Gly Lys
    210                     215                     220
```

```
Arg Ser Arg Ser Ser Val Glu Lys Pro Thr Val Leu Thr Val His Glu
225                 230                 235                 240
Ala Gln Gly Glu Thr Tyr Arg Lys Val Asn Leu Val Arg Thr Lys Phe
                245                 250                 255
Gln Glu Asp Asp Pro Phe Arg Ser Glu Asn His Ile Thr Val Ala Leu
                260                 265                 270
Ser Arg His Val Glu Ser Leu Thr Tyr Ser Val Leu Ser Ser Lys Arg
            275                 280                 285
Asp Asp Ala Ile Ala Gln Ala Ile Val Lys Ala Lys Gln Leu Val Asp
            290                 295                 300
Ala Tyr Arg Val Tyr Pro Thr Ser Phe Gly Gly Ser
305                 310                 315


<210> 27
<211> 298
<212> PRT
<213> Beet Yellows Virus

<400> 27
Ile Thr Thr Phe Lys Leu Met Val Lys Arg Asp Ala Lys Val Lys Leu
1               5                   10                  15
Asp Ser Ser Cys Leu Val Lys His Pro Pro Ala Gln Asn Ile Met Phe
                20                  25                  30
His Arg Lys Ala Val Asn Ala Ile Phe Ser Pro Cys Phe Asp Glu Phe
            35                  40                  45
Lys Asn Arg Val Ile Thr Cys Thr Asn Ser Asn Ile Val Phe Phe Thr
            50                  55                  60
Glu Met Thr Asn Ser Thr Leu Ala Ser Ile Ala Lys Glu Met Leu Gly
65                  70                  75                  80
Ser Glu His Val Tyr Asn Val Gly Glu Ile Asp Phe Ser Lys Phe Asp
                85                  90                  95
Lys Ser Gln Asp Ala Phe Ile Lys Ser Phe Glu Arg Thr Leu Tyr Ser
                100                 105                 110
Ala Phe Gly Phe Asp Glu Asp Leu Leu Asp Val Trp Met Gln Gly Glu
            115                 120                 125
Tyr Thr Ser Asn Ala Thr Thr Leu Asp Gly Gln Leu Ser Phe Ser Val
    130                 135                 140
Asp Asn Gln Arg Lys Ser Gly Ala Ser Asn Thr Trp Ile Gly Asn Ser
145                 150                 155                 160
Ile Glu Thr Leu Gly Ile Leu Ser Met Phe Tyr Tyr Thr Asn Arg Phe
                165                 170                 175
Lys Ala Leu Phe Val Ser Gly Asp Asp Ser Leu Ile Phe Ser Glu Ser
                180                 185                 190
Pro Ile Arg Asn Ser Ala Asp Ala Met Cys Thr Glu Leu Gly Phe Glu
            195                 200                 205
Thr Lys Phe Leu Thr Pro Ser Val Pro Tyr Phe Cys Ser Lys Phe Phe
    210                 215                 220
Val Met Thr Gly His Asp Val Phe Phe Val Pro Asp Pro Tyr Lys Leu
225                 230                 235                 240
Leu Val Lys Leu Gly Ala Ser Lys Asp Glu Val Asp Asp Glu Phe Leu
                245                 250                 255
Phe Glu Val Phe Thr Ser Phe Arg Asp Leu Thr Lys Asp Leu Val Asp
                260                 265                 270
Glu Arg Val Ile Glu Leu Leu Thr His Leu Val His Ser Lys Tyr Gly
            275                 280                 285
Tyr Glu Ser Gly Asp Thr Tyr Ala Ala Leu
    290                 295
```

<210> 28
<211> 52
<212> DNA
<213> Grapevine Leafroll Virus

<400> 28
caugauaagc agcguguuua gcguaguucg gucgcaggcg auuccgcgua ga          52

<210> 29
<211> 52
<212> DNA
<213> Beet Yellows Virus

<400> 29
cacgacccgc agcggguuua gctcgauucg cucgcaggcg auuccuaaga gg          52

<210> 30
<211> 52
<212> DNA
<213> Beet Yellow Stunt Virus

<400> 30
cacgaugaac agcgcguuua gcguaguuag gucgcaggcc aucccuaaaa gg          52

<210> 31
<211> 52
<212> DNA
<213> Citrus Tristeza Virus

<400> 31
cacgaaccgg cucgcguucg gcguaguaag gucacaagca auuccuccaa ga          52

<210> 32
<211> 17
<212> PRT
<213> Grapevine Leafroll Virus

<400> 32
His Asp Lys Gln Arg Val Ser Val Val Arg Ser Gln Ala Ile Pro Arg
1               5                   10                  15
Arg


<210> 33
<211> 17
<212> PRT
<213> Beet Yellows Virus

<400> 33
His Asp Pro Gln Arg Val Ser Ser Ile Arg Ser Gln Ala Ile Pro Lys
1               5                   10                  15
Arg


<210> 34
<211> 17
<212> PRT

<213> Beet Yellow Stunt Virus

<400> 34
His Asp Glu Gln Arg Val Ser Val Val Arg Ser Gln Ala Ile Pro Lys
1               5                   10                  15
Arg


<210> 35
<211> 17
<212> PRT
<213> Citrus Tristeza Virus

<400> 35
His Glu Pro Ala Arg Val Gly Val Val Arg Ser Gln Ala Ile Pro Pro
1               5                   10                  15
Arg


<210> 36
<211> 598
<212> PRT
<213> Beet Yellows Virus

<400> 36
Met Val Val Phe Gly Leu Asp Phe Gly Thr Thr Phe Ser Ser Val Cys
1               5                   10                  15
Ala Tyr Val Gly Glu Glu Leu Tyr Leu Phe Lys Gln Arg Asp Ser Ala
            20                  25                  30
Tyr Ile Pro Thr Tyr Val Phe Leu His Ser Asp Thr Gln Glu Val Ala
            35                  40                  45
Phe Gly Tyr Asp Ala Glu Val Leu Ser Asn Asp Leu Ser Val Arg Gly
        50                  55                  60
Gly Phe Tyr Arg Asp Leu Lys Arg Trp Ile Gly Cys Asp Glu Glu Asn
65                  70                  75                  80
Tyr Arg Asp Tyr Leu Glu Lys Leu Lys Pro His Tyr Lys Thr Glu Leu
                85                  90                  95
Leu Lys Val Ala Gln Ser Ser Lys Ser Thr Val Lys Leu Asp Cys Tyr
                100                 105                 110
Ser Gly Thr Val Pro Gln Asn Ala Thr Leu Pro Gly Leu Ile Ala Thr
            115                 120                 125
Phe Val Lys Ala Leu Ile Ser Thr Ala Ser Glu Ala Phe Lys Cys Gln
            130                 135                 140
Cys Thr Gly Val Ile Cys Ser Val Pro Ala Asn Tyr Asn Cys Leu Gln
145                 150                 155                 160
Arg Ser Phe Thr Glu Ser Cys Val Asn Leu Ser Gly Tyr Pro Cys Val
                165                 170                 175
Tyr Met Val Asn Glu Pro Ser Ala Ala Ala Leu Ser Ala Cys Ser Arg
                180                 185                 190
Ile Lys Gly Ala Thr Ser Pro Val Leu Val Tyr Asp Phe Gly Gly Gly
            195                 200                 205
Thr Phe Asp Val Ser Val Ile Ser Ala Leu Asn Asn Thr Phe Val Val
            210                 215                 220
Arg Ala Ser Gly Gly Asp Met Asn Leu Gly Gly Arg Asp Ile Asp Lys
225                 230                 235                 240
Ala Phe Val Glu His Leu Tyr Asn Lys Ala Gln Leu Pro Val Asn Tyr
                245                 250                 255

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```
Lys Ile Asp Ile Ser Phe Leu Lys Glu Ser Leu Ser Lys Lys Val Ser
        260                     265                     270
Phe Leu Asn Phe Pro Val Val Ser Glu Gln Gly Val Arg Val Asp Val
        275                     280                     285
Leu Val Asn Val Ser Glu Leu Ala Glu Val Ala Ala Pro Phe Val Glu
        290                     295                     300
Arg Thr Ile Lys Ile Val Lys Glu Val Tyr Glu Lys Tyr Cys Ser Ser
305                     310                     315                     320
Met Arg Leu Glu Pro Asn Val Lys Ala Lys Leu Leu Met Val Gly Gly
                325                     330                     335
Ser Ser Tyr Leu Pro Gly Leu Leu Ser Arg Leu Ser Ser Ile Pro Phe
            340                     345                     350
Val Asp Glu Cys Leu Val Leu Pro Asp Ala Arg Ala Ala Val Ala Gly
        355                     360                     365
Gly Cys Ala Leu Tyr Ser Ala Cys Leu Arg Asn Asp Ser Pro Met Leu
        370                     375                     380
Leu Val Asp Cys Ala Ala His Asn Leu Ser Ile Ser Ser Lys Tyr Cys
385                     390                     395                     400
Glu Ser Ile Val Cys Val Pro Ala Gly Ser Pro Ile Pro Phe Thr Gly
                405                     410                     415
Val Arg Thr Val Asn Met Thr Gly Ser Asn Ala Ser Ala Val Tyr Ser
                420                     425                     430
Ala Ala Leu Phe Glu Gly Asp Phe Val Lys Cys Arg Leu Asn Lys Arg
            435                     440                     445
Ile Phe Phe Gly Asp Val Val Leu Gly Asn Val Gly Val Thr Gly Ser
        450                     455                     460
Ala Thr Arg Thr Val Pro Leu Thr Leu Glu Ile Asn Val Ser Ser Val
465                     470                     475                     480
Gly Thr Ile Ser Phe Ser Leu Val Gly Pro Thr Gly Val Lys Lys Leu
                485                     490                     495
Ile Gly Gly Asn Ala Ala Tyr Asp Phe Ser Ser Tyr Gln Leu Gly Glu
                500                     505                     510
Arg Val Val Ala Asp Leu His Lys His Asn Ser Asp Lys Val Lys Leu
        515                     520                     525
Ile His Ala Leu Thr Tyr Gln Pro Phe Gln Arg Lys Lys Leu Thr Asp
        530                     535                     540
Gly Asp Lys Ala Leu Phe Leu Lys Arg Leu Thr Ala Asp Tyr Arg Arg
545                     550                     555                     560
Glu Ala Arg Lys Phe Ser Ser Tyr Asp Asp Ala Val Leu Asn Ser Ser
                565                     570                     575
Glu Leu Leu Leu Gly Arg Ile Ile Pro Lys Ile Leu Arg Gly Ser Arg
            580                     585                     590
Val Glu Lys Leu Asp Val
            595
```

<210> 37
<211> 204
<212> PRT
<213> Beet Yellows Virus

<400> 37
```
Met Gly Ser Ala Glu Pro Ile Ser Ala Ile Ala Thr Phe Glu Asn Val
1                   5                   10                  15
Ser Leu Ala Asp Gln Thr Cys Leu His Gly Glu Asp Cys Asp Lys Leu
            20                  25                  30
Arg Lys Asn Phe Glu Glu Cys Leu Lys Leu Lys Gly Val Pro Glu Asp
        35                  40                  45
Asn Leu Gly Ile Ala Leu Gly Leu Cys Leu Tyr Ser Cys Ala Thr Ile
```

```
      50                        55                        60
Gly Thr Ser Asn Lys Val Asn Val Gln Pro Thr Ser Thr Phe Ile Lys
65                        70                        75                        80
Ala Ser Phe Gly Gly Gly Lys Glu Leu Tyr Leu Thr His Gly Glu Ile
                          85                        90                        95
Asn Ser Phe Leu Gly Ser Gln Lys Leu Leu Glu Gly Lys Pro Asn Lys
                100                       105                       110
Leu Arg Cys Phe Cys Arg Thr Phe Gln Lys Asp Tyr Ile Ser Leu Arg
            115                       120                       125
Lys Glu Tyr Arg Gly Lys Leu Pro Pro Ile Ala Arg Ala Asn Arg His
        130                       135                       140
Gly Leu Pro Ala Glu Asp His Tyr Leu Ala Ala Asp Phe Ile Ser Thr
145                       150                       155                       160
Ser Thr Glu Leu Thr Asp Leu Gln Gln Ser Arg Leu Leu Leu Ala Arg
                165                       170                       175
Glu Asn Ala Thr His Thr Glu Phe Ser Ser Glu Ser Pro Val Thr Ser
                180                       185                       190
Leu Lys Gln Leu Gly Arg Gly Leu Gly Thr Gly Arg
                195                       200
```

<210> 38
<211> 216
<212> PRT
<213> Beet Yellows Virus

<400> 38
```
Met Leu Ala Pro Glu Ala Arg Gly Asp Leu Ile His Phe Thr Glu Asn
1                 5                       10                        15
Thr Arg Asp Ala Met Glu Thr Phe Phe Asn Ser Tyr Asp Leu Ala Glu
                20                        25                        30
Tyr Ser Glu Val Asn Pro Asn Lys Leu Asn Arg Lys Glu Thr Asp Glu
        35                        40                        45
Leu Leu Gly Val Ile Arg Glu Arg Phe Lys Ser Glu Leu Val Ile Thr
    50                        55                        60
Asp Glu Asp Phe Val Lys His Leu Ala Phe Ala Leu Ile Arg Ala Ala
65                        70                        75                        80
Asn Ile Thr Thr Ser Val Lys Val Asn Tyr Val Gly Ala Tyr Glu Tyr
                85                        90                        95
Thr Ile Gly Gly Lys Lys Phe Leu Val Lys Asp Ala Trp Val Phe Pro
                100                       105                       110
Leu Ile Lys Glu Cys Met Lys Lys Phe Asn Lys Pro Asn Pro Val Arg
            115                       120                       125
Thr Phe Cys Ala Thr Phe Glu Asp Ala Tyr Ile Val Ile Ala Arg Ser
        130                       135                       140
Leu Pro Lys Leu Phe Ile Asn Arg Thr Ile Gly Lys Arg Gly Ile Pro
145                       150                       155                       160
Ser Gly Tyr Glu Phe Leu Gly Ala Asp Phe Leu Thr Ala Thr Ser Val
                165                       170                       175
Cys Leu Asn Asp His Glu Lys Ala Ile Val Leu Gln Ala Ser Arg Ala
                180                       185                       190
Ala Ile Asp Arg Ala Val Ser Ser Ser Val Asp Gly Lys Ile Val Ser
                195                       200                       205
Leu Phe Asp Leu Gly Arg Leu Ser
        210                       215
```

<210> 39
<211> 215

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<212> PRT
<213> Beet Yellow Stunt Virus

<400> 39

```
Met Ala Gly Gly Asn Asp Glu Gly Ser Asp Asp Ser Ser Ala Ser Gln
1               5                   10                  15
Thr Met Thr Ala Lys Asp Met Ile Phe Ala Pro Phe Glu Asn Phe Ala
            20                  25                  30
Arg Ala Ser Ala Thr Cys Leu Asn Gly Glu Asn Lys Lys Lys Leu Phe
        35                  40                  45
Glu Glu Phe Ser Val Arg Val Lys Thr Gln Asp Val Thr Glu Ser Gly
    50                  55                  60
Ile Pro Thr Thr Leu Gly Met Thr Leu Tyr Ala Leu Ala Thr Leu Ser
65                  70                  75                  80
Thr Ser Ser Lys Ile Asp Ile Glu Asp Lys Thr Pro Leu Val Ser Ala
                85                  90                  95
Lys Ile Asp Ala Val Asn Val Thr Ile Thr Tyr Glu Asp Ile Lys Asn
            100                 105                 110
Phe Val Asn Ser Leu Thr Leu Leu Lys Asn Tyr Lys Asn Lys Leu Arg
        115                 120                 125
Val Phe Ala Arg Thr Phe Glu Glu Glu Tyr Leu Arg Phe Val Arg Gln
    130                 135                 140
Tyr Lys His Ile Leu Pro Asn Ile Ala Arg Ala Asn Lys His Gly Ile
145                 150                 155                 160
Pro Ala Asp Tyr Ser Tyr Leu Ala Ala Asp Phe Val Gln Thr Ser Asn
                165                 170                 175
Leu Leu Lys Glu His Glu Gln Ala Val Leu Leu Glu Gly Arg Asn Ala
            180                 185                 190
Ala Thr Ala Ser Ser Gly Thr Thr Arg Glu Ser Ala Val Asn Leu Lys
            195                 200                 205
Tyr Leu Gly Gly Ser Ser Lys
    210                 215
```

<210> 40
<211> 226
<212> PRT
<213> Beet Yellow Stunt Virus

<400> 40

```
Met Pro Pro Gln Pro Gly Ala Glu Leu Val Glu His Asn Ala Asn Lys
1               5                   10                  15
Ser Ser Leu Glu Val Phe Ser Ser Glu Thr Arg Glu Lys Val Gly Lys
            20                  25                  30
Phe Phe Asn Asn Phe Asp His Lys Thr Phe Lys Gln Val Asn Pro Asn
        35                  40                  45
Leu Leu Asn Glu Asp Glu Leu Arg Glu Val Leu Gly Lys Leu Thr Glu
    50                  55                  60
Leu Lys Thr Asn Leu Lys Ala Leu Asp Glu Asp Ile Tyr His His Val
65                  70                  75                  80
Ala Phe Phe Leu Leu Arg Ala Ser Val Val Ser Thr Ser Pro Lys Val
                85                  90                  95
Glu Tyr Lys Gly Ser Tyr Ser Tyr Ser Ile Asp Gln Arg Lys Tyr Thr
            100                 105                 110
Val Asn Asp Ala Trp Ile Phe Pro Gln Val Lys Ile Leu Ala Ser Lys
        115                 120                 125
His Asn Lys Pro Asn Gly Leu Arg Ala Phe Cys Ala Ser Leu Glu Gly
    130                 135                 140
Met Tyr Leu Ser Val Ala Arg Leu Gly Pro Asp Ala Phe Gly Thr Arg
```

```
         145                    150                    155                    160
Ser Val Gly Lys Arg Gly Ala Pro Ser Gly Ser Glu Tyr Leu Gly Ala
                        165                    170                    175
Asp Phe Leu Thr Ser Thr Cys Pro Leu Met Ser Asp His Asp Arg Ala
                180                    185                    190
Val Ala Leu Ser Ala Ser Arg Asn Ala Leu Asp Arg Ser Ala Ala Ser
            195                    200                    205
Gln Ile Asp Lys Lys Met Val Ser Leu Tyr Asp Phe Gly Lys Val Val
        210                    215                    220
Tyr Thr
225
```

&lt;400&gt; 41

```
Met Asp Asp Glu Thr Lys Lys Leu Lys Asn Lys Asn Lys Glu Thr Lys
1                   5                   10                  15
Glu Gly Asp Asp Val Val Ala Ala Glu Ser Ser Phe Ser Ser Val Asn
                20                  25                  30
Leu His Ile Asp Pro Thr Leu Ile Thr Met Asn Asp Val Arg Gln Leu
        35                  40                  45
Ser Thr Gln Gln Asn Ala Ala Leu Asn Arg Asp Leu Phe Leu Thr Leu
    50                  55                  60
Lys Gly Lys His Pro Asn Leu Pro Asp Lys Asp Lys Asp Phe Arg Ile
65                  70                  75                  80
Ala Met Met Leu Tyr Arg Leu Ala Val Lys Ser Ser Ser Leu Gln Ser
                85                  90                  95
Asp Asp Asp Ala Thr Gly Ile Thr Tyr Thr Arg Glu Gly Val Glu Val
            100                 105                 110
Asp Leu Ser Asp Lys Leu Trp Ile Asp Val Val Phe Asn Ser Lys Gly
        115                 120                 125
Ile Gly Asn Arg Thr Asn Ala Leu Arg Val Trp Gly Arg Thr Asn Asp
        130                 135                 140
Ala Leu Tyr Leu Ala Phe Cys Arg Gln Asn Arg Asn Leu Ser Tyr Gly
145                 150                 155           .     160
Gly Arg Pro Leu Asp Ala Gly Ile Pro Ala Gly Tyr His Tyr Leu Cys
                165                 170                 175
Ala Asp Phe Leu Thr Gly Ala Gly Leu Thr Asp Leu Glu Cys Ala Val
                180                 185                 190
Tyr Ile Gln Ala Lys Glu Gln Leu Leu Lys Lys Arg Gly Ala Asp Asp
            195                 200                 205
Val Val Val Thr Asn Val Arg Gln Leu Gly Lys Phe Asn Thr Arg
        210                 215                 220
```

&lt;400&gt; 42

```
Met Ala Gly Tyr Thr Val Leu Pro Lys Thr Asp Asp Lys Glu Met Asp
1                   5                   10                  15
Pro Val Ser Ala Ala Val Pro Gly Lys Tyr Pro Asp Val Ile Glu Lys
                20                  25                  30
```

Phe Val Ala Asn Arg Ser Val Asp Ala Leu Ile Glu Gly Val Ile Ser
        35                  40                  45
Lys Leu Asp Thr Asn Ser Ile Tyr Glu Asp Ser Thr Glu Lys Phe Thr
    50                  55                  60
Gly Glu His Leu Lys Tyr Val Met Val Thr Met Asp Thr Phe Leu Leu
65                  70                  75                      80
Glu Asn Tyr Lys Thr Lys Thr Glu Asp Leu Leu Val His Leu Thr Met
                85                  90                  95
Ile Gln Lys Arg Leu Tyr Thr Ile Ser Thr Ser Thr Lys Thr Lys Phe
                100                 105                 110
Arg Asp Lys Gly Cys Ile Ser Tyr Val Gln Gly Gly Leu Arg Tyr Lys
            115                 120                 125
Leu Leu Asp Lys Val Val Phe Pro Phe Ile Leu Ser Lys Phe Thr Asp
    130                 135                 140
Arg Glu Thr Pro Asn Ala Leu Arg Lys Phe Ala Cys Thr Phe Glu Glu
145                 150                 155                 160
Leu His Leu Cys Met Ala Arg Leu Arg Pro Asp Leu Tyr Glu Asn Lys
                165                 170                 175
Arg Thr Thr Arg Ala Gly Thr Pro His Leu Lys Gly Tyr Leu Ser Ala
            180                 185                 190
Asp Phe Leu Ser Gly Ser Leu Pro Gly Tyr Ser Glu His Glu Arg Gly
        195                 200                 205
Ile Ile Leu Arg Ala Ser Glu Ser Met Leu Ala Arg Arg Gln Gly Tyr
    210                 215                 220
Glu Glu Ala Thr Glu Leu Leu Asn Leu Arg Asp Leu Gly Lys Tyr Leu
225                 230                 235                 240


<210> 43
<211> 553
<212> PRT
<213> Beet Yellows Virus

<400> 43
Met Thr Thr Arg Phe Ser Thr Pro Ala Asn Tyr Tyr Trp Gly Glu Leu
  1               5                   10                  15
Phe Arg Arg Phe Phe Gly Gly Gln Glu Trp Lys Asn Leu Met Ser Glu
                20                  25                  30
Ala Ala Ser Val Ser Arg Pro Arg Tyr Ser Ser Asp Phe Arg Phe Ser
            35                  40                  45
Asp Gly Val Ile Leu Ser Arg Lys Thr Phe Gly Glu Ser Thr Gly Glu
    50                  55                  60
Ser Phe Val Arg Glu Phe Ser Leu Leu Leu Thr Phe Pro Lys Thr Tyr
65                  70                  75                      80
Glu Val Cys Lys Leu Cys Gly Val Ala Met Glu Leu Ala Leu Asn Gly
                85                  90                  95
Met Asn Arg Leu Ser Asp Tyr Asn Val Ser Glu Phe Asn Ile Val Asp
                100                 105                 110
Val Lys Thr Val Gly Cys Lys Phe Asn Ile Gln Ser Val Thr Glu Phe
            115                 120                 125
Val Lys Lys Ile Asn Gly Asn Val Ala Glu Pro Ser Leu Val Glu His
    130                 135                 140
Cys Trp Ser Leu Ser Asn Ser Cys Gly Glu Leu Ile Asn Pro Lys Asp
145                 150                 155                 160
Thr Lys Arg Phe Val Ser Leu Ile Phe Lys Gly Lys Asp Leu Ala Glu
                165                 170                 175
Ser Thr Asp Glu Ala Ile Val Ser Ser Ser Tyr Leu Asp Tyr Leu Ser
            180                 185                 190
His Cys Leu Asn Leu Tyr Glu Thr Cys Asn Leu Ser Ser Asn Ser Gly

```
            195                    200                    205
Lys Lys Ser Leu Tyr Asp Glu Phe Leu Lys His Val Ile Asp Tyr Leu
        210                215                220
Glu Asn Ser Asp Leu Glu Tyr Arg Ser Pro Ser Asp Asn Pro Leu Val
225                230                235                240
Ala Gly Ile Leu Tyr Asp Met Cys Phe Glu Tyr Asn Thr Leu Lys Ser
                245                250                255
Thr Tyr Leu Lys Asn Ile Glu Ser Phe Asp Cys Phe Leu Ser Leu Tyr
            260                265                270
Leu Pro Leu Leu Ser Glu Val Phe Ser Met Asn Trp Glu Arg Pro Ala
            275                280                285
Pro Asp Val Arg Leu Leu Phe Glu Leu Asp Ala Ala Glu Leu Leu Leu
        290                295                300
Lys Val Pro Thr Ile Asn Met His Asp Ser Thr Phe Leu Tyr Lys Asn
305                310                315                320
Lys Leu Arg Tyr Leu Glu Ser Tyr Phe Glu Asp Asp Ser Asn Glu Leu
                325                330                335
Ile Lys Val Lys Val Asp Ser Leu Leu Thr Arg Asp Asn Pro Glu Leu
            340                345                350
Lys Leu Ala Gln Arg Trp Val Gly Phe His Cys Tyr Tyr Gly Val Phe
            355                360                365
Arg Thr Ala Gln Thr Arg Lys Val Lys Arg Asp Ala Glu Tyr Lys Leu
        370                375                380
Pro Pro Ala Leu Gly Glu Phe Val Ile Asn Met Ser Gly Val Glu Glu
385                390                395                400
Phe Phe Glu Glu Leu Gln Lys Lys Met Pro Ser Ile Ser Val Arg Arg
                405                410                415
Arg Phe Cys Gly Ser Leu Ser His Glu Ala Phe Ser Val Phe Lys Arg
            420                425                430
Phe Gly Val Gly Phe Pro Pro Ile Thr Arg Leu Asn Val Pro Val Lys
            435                440                445
Tyr Ser Tyr Leu Asn Val Asp Tyr Tyr Arg His Val Lys Arg Val Gly
        450                455                460
Leu Thr Gln Asp Glu Leu Thr Ile Leu Ser Asn Ile Glu Phe Asp Val
465                470                475                480
Ala Glu Met Cys Cys Glu Arg Glu Val Ala Leu Gln Ala Arg Arg Ala
                485                490                495
Gln Arg Gly Glu Lys Pro Phe Gln Gly Trp Lys Gly Thr Lys Asn Glu
            500                505                510
Ile Ser Pro His Ala Arg Ser Ser Ile Arg Val Lys Lys Asn Asn Asp
            515                520                525
Ser Leu Leu Asn Ile Leu Trp Lys Asp Val Gly Ala Arg Ser Gln Arg
        530                535                540
Arg Leu Asn Pro Leu His Arg Lys His
545                550
```

```
Met Ser Arg Arg Pro Thr Phe Ala Gly Tyr Ser Trp Gly Ser Leu Phe
 1               5                  10                 15
Lys Arg His Tyr Gly Glu Pro Glu Trp Lys Ser Tyr Leu Thr Glu Thr
            20                 25                 30
Ser Met Lys Tyr Lys Pro Leu Lys Ser Glu Ser Ile Thr Phe Tyr Asp
            35                 40                 45
```

```
Gly Ser Ser Leu Thr Ser Ala Glu Leu Arg Pro Ala Arg Ser Gly Thr
    50              55              60
Ala Glu Tyr Glu Ile Ala Leu Leu Ile Phe Ser Asp Ser Ile Thr Lys
65              70              75              80
Trp Ser Glu Lys Leu Glu Arg Ser Ile Tyr Arg Gly Leu Asn Gln Ile
            85              90              95
Asn Asn His Ser Ile Tyr Ala Glu Thr Glu Leu Glu Val Thr Asp Val
            100             105             110
Lys Thr Ile Gly Cys Lys Phe Thr Ile Ser Ala Val Glu Ser Phe Met
            115             120             125
Gly Gly Arg Ala Ser Ala Ala Gln Val Glu His Cys Trp Ser Leu Ser
    130             135             140
Asn Ser Cys Gly Glu Leu Ile Asn Pro Asn Asp Thr Ala Arg Phe Ile
145             150             155             160
Gln Leu Val Phe Lys Asp Lys Ala Val Thr Glu Gln Ala Gln Val Asn
            165             170             175
Thr Ser Gly Ser Val Ser Asp Tyr Leu Val Tyr Cys Leu Gln Leu Tyr
            180             185             190
Asp Asn Ser Lys Lys Lys Ser Asn Ala Gly Arg Thr Gln Leu Met Glu
            195             200             205
Ser Tyr Val Ser Phe Ile Arg Asp Phe Phe Gln His Ser Asp Leu Tyr
    210             215             220
Tyr Arg Ser Pro Leu Asp Asn Pro Leu Leu Thr Gly Val Leu Tyr Asp
225             230             235             240
Leu Cys Ile Glu His Asn Val Leu Arg Gly Ser Tyr Leu Lys Asn Leu
            245             250             255
Asp Asn Phe Arg Leu Phe Lys Gln Thr Tyr Leu Pro Met Ile Asp Asp
            260             265             270
Ile Phe Asp Tyr Ser Trp Glu Leu Tyr Ala Pro Asp Glu Arg Leu Leu
            275             280             285
Phe Pro Ile Asp Pro Tyr Glu Ile Ile Lys Glu Val Pro Thr Met Ser
    290             295             300
Val Ile Asp Ala Asn Val Val Leu Ser Asn Lys Leu Val Tyr Leu Asp
305             310             315             320
Ser Tyr Leu Glu Asn Asn Ser Ile Leu Ala Leu Glu Lys Lys Ile Ile
            325             330             335
Ser Ile Leu Cys Arg Asp Asn Glu Gly Ile Asp Glu Gly Ala Leu Trp
            340             345             350
Ala Ala Phe Phe Cys Tyr Tyr Gly Thr Tyr Arg Thr Ala Arg Gln Arg
    355             360             365
Val Val Lys Arg Pro Asp Thr Tyr Glu Leu Asp Gly Ile Phe Ser Lys
370             375             380
Pro Ile Val Met Ser Gly Val Glu Leu Phe Phe Asp Glu Leu Gln Lys
385             390             395             400
Arg Val Pro Asp Val Ser Leu Arg Arg Arg Phe Asn Gly Ala Lys Ala
            405             410             415
Gly Glu Ala Ile Thr Val Phe Lys Lys Leu Gly Ile Ser Phe Pro Pro
            420             425             430
Ile Thr Arg Leu Asn Ala Pro Ser Lys Tyr Ser Tyr Leu Asn Ile Asp
            435             440             445
Tyr Phe Lys Gln Ala Asn Ser Leu Gly Leu Thr Glu Pro Glu Lys Ile
    450             455             460
Ile Leu Cys Asn Ile Ala Lys Asp Val Asp Met Met Cys Ala Gln Arg
465             470             475             480
Ile Ser Ser Val Lys Ala Lys Pro Ile Ala Gln Arg Asn Gly Glu Ala
            485             490             495
Ile Asn Ser Ala Lys Ile Arg Thr Leu Pro Thr Asn Thr Leu Val Arg
            500             505             510
Ala Leu Glu Lys Cys Leu Leu Asn Gln Ala Pro Ser Trp Trp Asn Thr
```

```
                515                 520                 525
Thr Leu Thr Asn Leu Arg
    530


<210> 45
<211> 535
<212> PRT
<213> Citrus Tristeza Virus

<400> 45
Met Ser Ser His His Val Trp Gly Ser Leu Phe Arg Lys Phe Tyr Gly
1               5                   10                  15
Glu Ala Ile Trp Lys Glu Tyr Leu Ser Glu Ser Thr Arg Asn Phe Asp
            20                  25                  30
Glu Arg Asn Val Ser Leu Asp His Thr Leu Ser Ser Gly Val Val Val
        35                  40                  45
Arg Arg Gln Ser Leu Leu Asn Ala Pro Gln Gly Thr Phe Glu Asn Glu
    50                  55                  60
Leu Ala Leu Leu Tyr Asn Ser Val Val Ile Asn Asp Phe Val Glu Leu
65                  70                  75                  80
Thr Gly Met Pro Leu Lys Ser Leu Met Thr Gly Ile Glu Asp Arg Lys
                85                  90                  95
Val Pro Asp Glu Leu Ile Ser Val Asp Pro His Glu Val Gly Cys Arg
            100                 105                 110
Phe Thr Leu Asn Asp Val Glu Ser Tyr Leu Met Ser Arg Gly Glu Asp
        115                 120                 125
Phe Ala Asp Leu Ala Ala Val Glu His Ser Trp Cys Leu Ser Asn Ser
    130                 135                 140
Cys Gly Arg Leu Leu Ser Ser Thr Glu Ile Asp Ala Tyr Lys Thr Leu
145                 150                 155                 160
Val Phe Thr Lys Asn Phe Asp Ser Asn Val Ser Gly Val Thr Thr Lys
                165                 170                 175
Leu Glu Thr Tyr Leu Ser Tyr Cys Ile Ser Leu Tyr Lys Lys His Cys
            180                 185                 190
Met Lys Asp Asp Asp Tyr Phe Asn Leu Ile Leu Pro Met Phe Asn Cys
            195                 200                 205
Leu Met Lys Val Leu Ala Ser Leu Gly Leu Phe Tyr Glu Lys His Ala
    210                 215                 220
Asp Asn Pro Leu Leu Thr Gly Met Leu Ile Glu Phe Cys Leu Glu Asn
225                 230                 235                 240
Lys Val Tyr Tyr Ser Thr Phe Lys Val Asn Leu Asp Asn Val Arg Leu
                245                 250                 255
Phe Lys Ser Lys Val Leu Pro Val Val Leu Thr Val Trp Asp Ile Ser
            260                 265                 270
Glu Pro Asp Asp Pro Met Asp Glu Arg Val Leu Ile Pro Phe Asp Pro
            275                 280                 285
Thr Asp Phe Val Leu Asp Leu Pro Lys Leu Asn Ile His Asp Thr Met
    290                 295                 300
Val Val Val Gly Asn Gln Ile Arg Gln Leu Glu Tyr Val Val Glu Ser
305                 310                 315                 320
Asp Ala Leu Asp Asp Leu Ser Gln His Val Asp Leu Arg Leu Ala Ala
                325                 330                 335
Asp Asn Pro Asp Leu Arg Val Gly Leu Arg Trp Ala Gly Met Phe Val
            340                 345                 350
Tyr Tyr Gly Val Tyr Arg Cys Val Val Asp Arg Ala Val Glu Arg Pro
            355                 360                 365
Thr Leu Phe Arg Leu Pro Gln Lys Leu Leu Ser Gln Asp Asp Gly Glu
    370                 375                 380
```

```
Ser Cys Ser Leu His Met Gly Ser Val Glu Ala Leu Phe Asn Leu Val
385             390                 395                     400
Gln Lys Val Asn Lys Asp Ile Asn Val Arg Arg Gln Phe Met Gly Arg
            405             410                     415
His Ser Glu Val Ala Leu Arg Leu Tyr Arg Asn Leu Gly Leu Arg Phe
            420                 425                 430
Pro Pro Ile Ser Ser Val Arg Leu Pro Ala His His Gly Tyr Leu Tyr
        435                 440                 445
Val Asp Phe Tyr Lys Arg Val Pro Asp Gly Ala Val Thr Ala Asp Glu
450                 455                 460
Leu Glu Ser Leu Arg Gln Leu Arg Ser Ser Val Asp Val Met Cys Lys
465             470                 475                     480
Asp Arg Val Ser Ile Thr Pro Pro Pro Phe Asn Arg Leu Arg Arg Gly
            485                 490                     495
Ser Ser Arg Thr Phe Arg Gly Arg Gly Ala Arg Gly Ala Ser Ser Arg
            500                 505                 510
His Met Ser Arg Asp Val Ala Thr Ser Gly Phe Asn Leu Pro Tyr His
            515                 520                 525
Gly Arg Leu Tyr Ser Thr Ser
    530                 535
```

```
<210> 46
<211> 61
<212> DNA
<213> Beet Yellows Virus

<400> 46
ttaagtcgtc acagagtgac aacggcacca agtggtgctt agtgcgtatg taaattacga 60
a                                                               61

<210> 47
<211> 61
<212> DNA
<213> Beet Yellow  Stunt Virus

<400> 47
ttaagccctc acagagcgag aacgttggca agagccaatt agtgtgtgtg tagtataatt 60
a                                                               61

<210> 48
<211> 61
<212> DNA
<213> Citrus Tristeza Virus

<400> 48
ctaagctccc acagagtggt agtggtctca agtgaggctt aacgtatgcg tgaaccaaag 60
a                                                               61
```